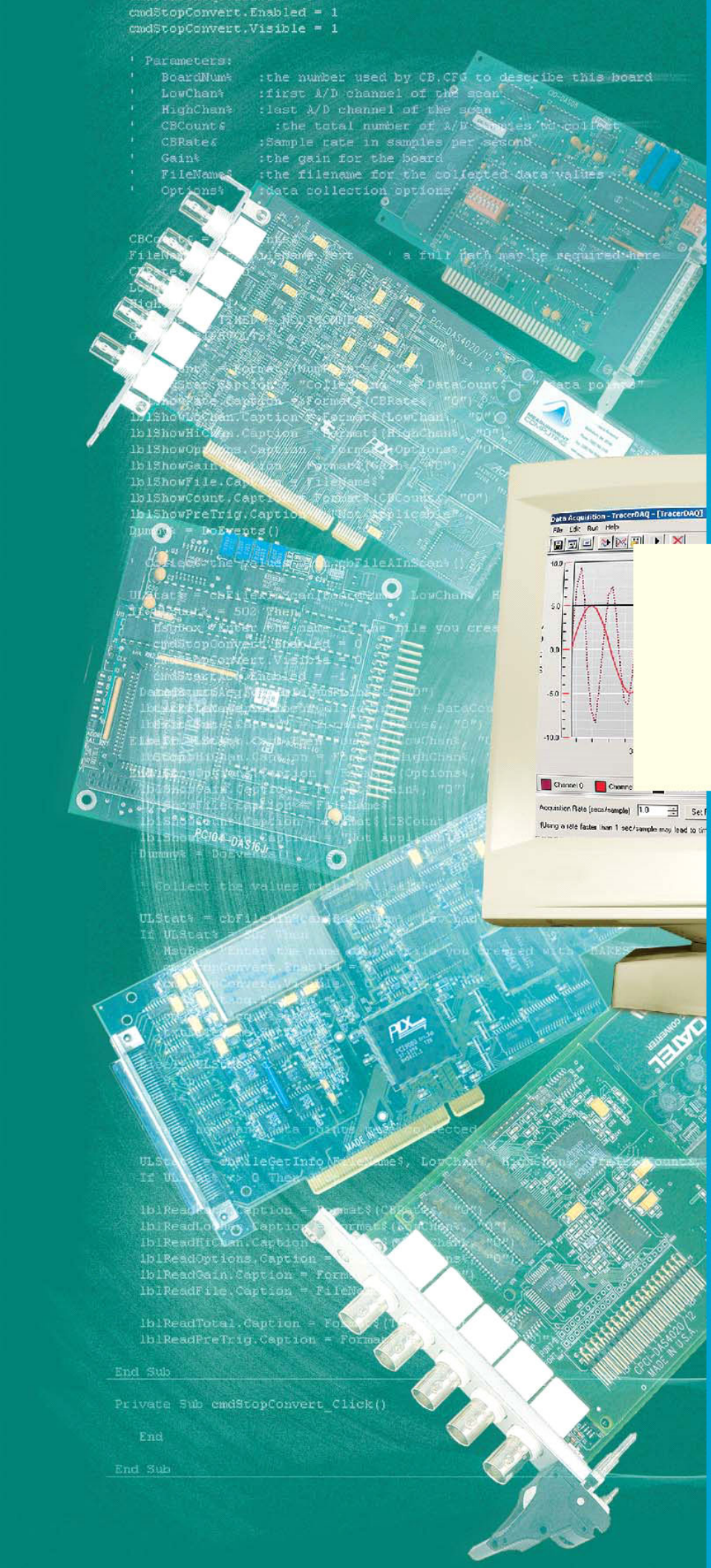


User's Guide

PCI-CTR05

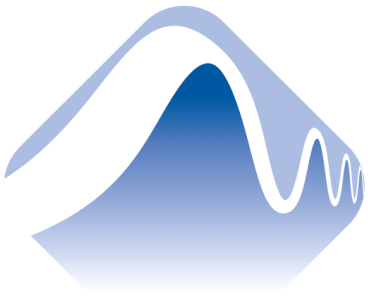
9513-Based Counter/Timer Board

MEASUREMENT COMPUTING™

PCI-CTR05

9513-Based Counter/Timer

User's Guide



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Document Revision 4, December, 2005
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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the PCI-CTR05 so that you get the most out of it's counter features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such those assigned to registers, bit settings, etc.

bold text Bold text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:

1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:

- The *Insta*Cal installation procedure is explained in the *Quick Start Guide*.
- *Never* touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide helpful information relevant to the operation of the PCI-CTR05.

- MCC's *Specifications: PCI-CTR05* (the PDF version of Chapter 4 in this guide) is available on our web site at www.mccdaq.com/pdfs/pci-ctr05r3.pdf.

Rev 2 hardware specifications

The specifications for hardware up to revision 2 are available on our web site at www.mccdaq.com/pdfs/pci-ctr05.pdf.

- MCC's *Register Map for the PCI-CTR05* is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-CTR05.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

This user's manual is also available on our web site at www.mccdaq.com/PDFmanuals/pci-ctr05.pdf.

Introducing the PCI-CTR05

The PCI-CTR05 is a high-performance, low-cost counter/timer board for PCI bus-compatible computers.

The PCI-CTR05 is based on the 9513 counter/timer device. The PCI-CTR05 has one 9513 counter/timer device. The 9513 device has five independent 16-bit counters (65,536 counts). Each counter has an input source, count register, load register, hold register, alarm register, output, and gate associated with each counter.

The 9513 is software-programmable for event counting, pulse and frequency measurement, alarm comparisons, and other input functions. The 9513 can generate frequencies with either complex duty cycles, or with one-shot and continuous-output modes. You can chain up to five 9513 counters together using software to enable a 32-, 48-, 64-, or 80-bit counter that does not require hardware connections. The gate source and gating functions are software-programmable.

An eight-bit, high-current digital output port provides logic-level control, and can be used to switch solid state relays. An eight-bit digital input port can be used to sense contact closures and other TTL level signals. The PCI-CTR05 also provides access to the PCI bus interrupt assigned to the board.

The PCI-CTR05 board (rev. 3 and later) is compatible with either 3.3 V or 5 V PCI signaling environments.

Compatibility with 3.3 V signaling only applies to boards at hardware revision 3 and later

Hardware revisions up to rev 2 support 5 V PCI signaling environments only.

For more information on the 9513 counter/timer, refer to the 9513 data sheet. This document is available at www.mccdaq.com/PDFmanuals/9513A.pdf.

Software features

The following software ships with the PCI-CTR05 free of charge.

- *Insta*Cal installation, calibration, test, and data logger utility
- TracerDAQ™ suite of virtual instruments
- SoftWIRE® for Visual Studio® .NET graphical programming (evaluation version)

For information on the features of *Insta*Cal, TracerDAQ, and SoftWIRE, refer to the *Quick Start Guide* that shipped with the PCI-CTR05.

Block diagram

The block diagram shown here illustrates the functionality of the PCI-CTR05.

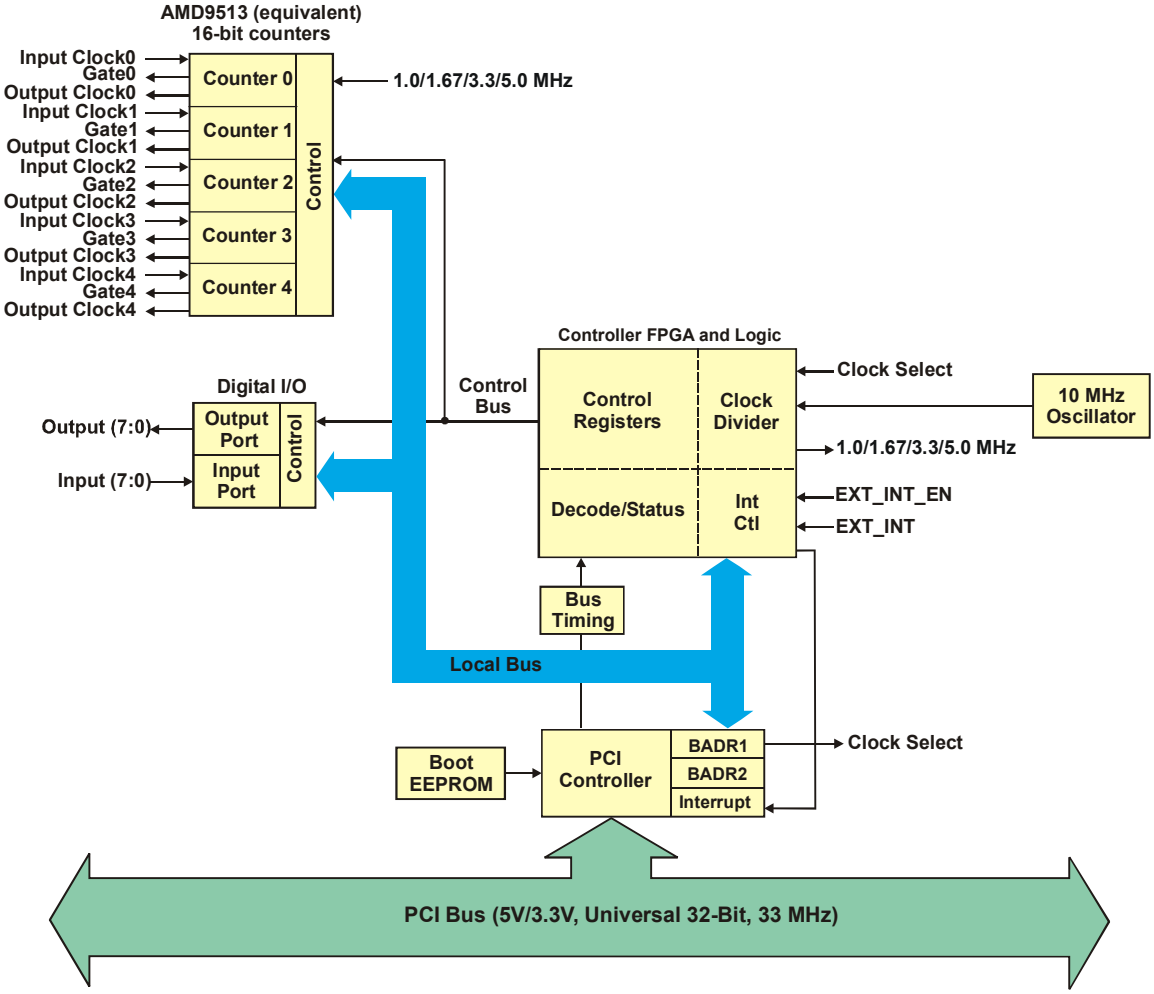


Figure 1-1. PCI-CTR05 functional block diagram

Installing the PCI-CTR05

What comes with your PCI-CTR05 shipment?

As you unpack your board, make sure that the following components are included.

Hardware

- PCI-CTR05

Software

The *Measurement Computing Data Acquisition Software* CD contains the following software:

- *Insta*Cal installation, calibration, and test utility
- TracerDAQ suite of virtual instruments
- SoftWIRE for VS .NET (evaluation version)

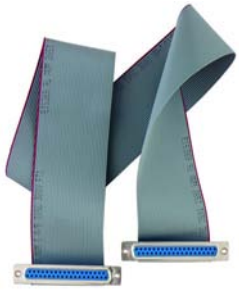
Documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). Please read this booklet completely before installing any software and hardware.

Optional components

If you ordered any of the following products with your board, they should be included with your shipment.

Cables



C37FF-x

C37FFS-x

Signal termination and conditioning accessories

MCC provides signal termination and signal conditioning products for use with the PCI-CTR05. Refer to Field wiring, signal termination and conditioning for a complete list of compatible accessory products.

Unpacking the board

The PCI-CTR05 board is shipped in an antistatic container to prevent damage by an electrostatic discharge. To avoid such damage, perform the following procedure when unpacking and handling your board:

1. Before opening the antistatic container, ground yourself with a wrist-grounding strap or by holding onto a grounded object (such as the computer chassis).
2. Touch the antistatic container to the computer chassis before removing the board from the container.
3. Remove the board from the container. *Never* touch the exposed pins or circuit connections on the board.

If your board is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail. For international customers, contact your local distributor where you purchased the PCI-CTR05.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@measurementcomputing.com

Installing the software

Install the software included with your board *before* you install the hardware. Installing the software first ensures that the information required for proper board detection is installed and available at boot up.

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the hardware

The PCI-CTR05 board is completely plug-and-play, with no switches or jumpers to set. Configuration is controlled by your system's BIOS. To install your board, follow the steps below.

Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Turn your computer off, open it up, and insert your board into an available PCI slot.
2. Close your computer and turn it on.

   If you are using an operating system with support for plug-and-play (such as Windows 2000 or Windows XP), a dialog box pops up as the system loads indicating that new hardware has been detected. If the information file for this board is not already loaded onto your PC, you will be prompted for the disk containing this file. The MCC DAQ software contains this file. If required, insert the *Measurement Computing Data Acquisition Software* CD and click **OK**.
3. To test your installation and configure your board, run the *Insta*Cal utility installed in the previous section. Refer to the *Quick Start Guide* that came with your board for information on how to initially set up and load *Insta*Cal.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

Table 2-1 lists the board connectors, applicable cables and compatible accessory boards.

Table 2-1. Board connectors, cables, accessory equipment

Connector type	37-pin shielded D-type, right angle (J1 – see Figure 2-1)
Compatible cables	C37FF-x, unshielded ribbon cable (Figure 2-2) C37FFS-x, shielded round cable (Figure 2-3)
Compatible accessory products	CIO-MINI37 CIO-MINI37-VERT CIO-TERMINAL SCB-37

The board connector is a male, 37-pin D-type connector (**J1**). Digital input, digital output, interrupt, and signals from the 9513 are all accessible on this connector.

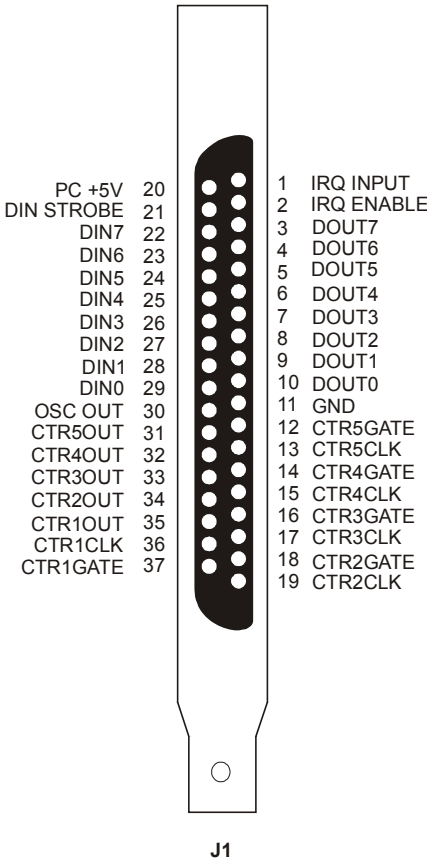


Figure 2-1. Board connector J1

Information on signal connections

For general information regarding digital I/O techniques, including signal conditioning and low pass filters, refer to the *Guide to Signal Connections*. This document is available on our web site at www.mccdaq.com/signals/signals.pdf).

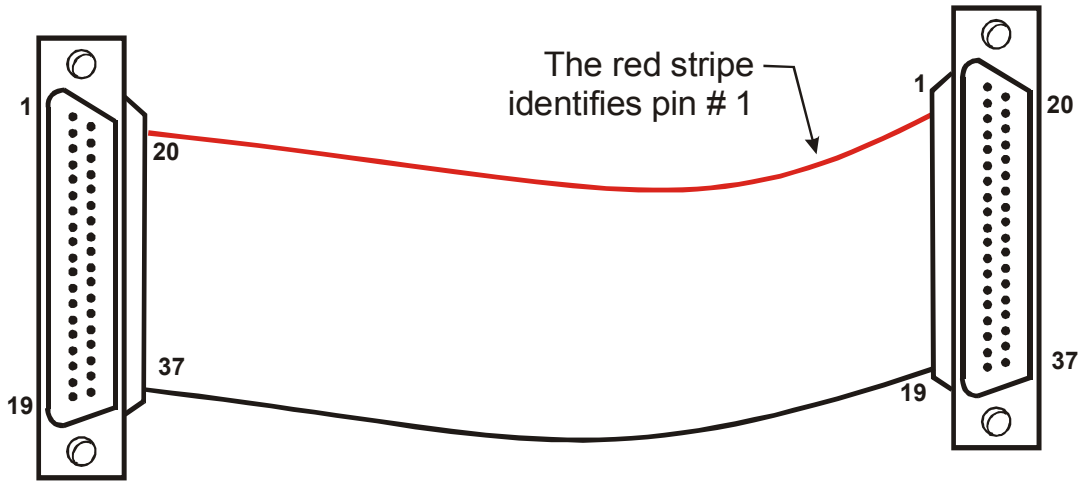


Figure 2-2. C37FF-x cable

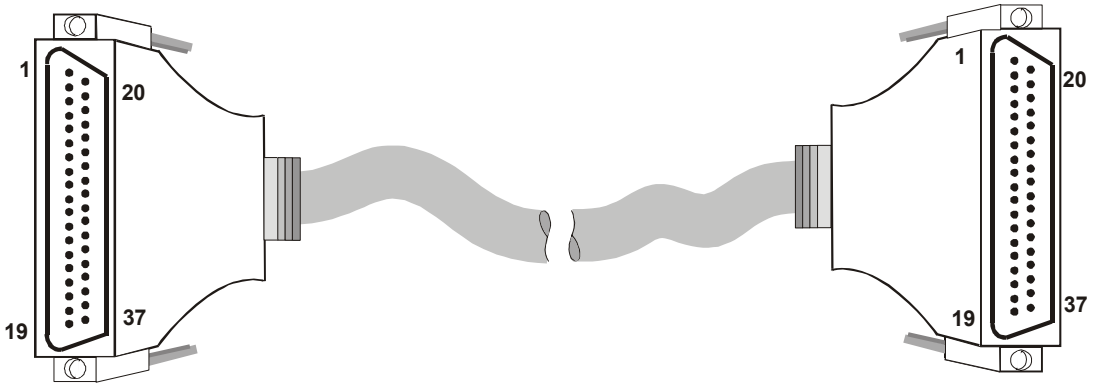


Figure 2-3. C37FFS-x cable

Field wiring, signal termination and conditioning

You can use the following MCC screw terminal boards with the PCI-CTR05 board using the C37FF-*x* or C37FFS-x cable.

- SCB37 — 37-conductor, shielded signal connection/screw terminal box that provides two independent 37-pin connections. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.
- CIO-MINI37 — 4 x 4, 37-pin screw terminal board. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- CIO-MINI37-VERT — 37-pin screw terminal accessory with vertical 37-pin male D connector. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=256.
- CIO-TERMINAL — 16 X 4 universal screw terminal board with on-board prototype area and circuitry. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282.

Programming and software applications

Programming languages

Measurement Computing's Universal Library™ provides access to board functions from a variety of Windows programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, please refer to the *Universal Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged application programs

Many packaged application programs, such as SoftWIRE®, Labtech Notebook™, and HP-VEE™, now have drivers for your board. If the package you own does not have drivers for your board, please fax or e-mail the package name and the revision number from the install disks. We will research the package for you and advise how to obtain drivers.

Some application drivers are included with the Universal Library package, but not with the application package. If you have purchased an application package directly from the software vendor, you may need to purchase our Universal Library and drivers. Please contact us by phone, fax or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@measurementcomputing.com

Register-level programming

We recommend that you use the Universal Library or one of the packaged application programs mentioned above for controlling your board. Only experienced programmers should attempt register level-programming.

If you must use register-level programming in your application, refer to the *Register Map for the PCI-CTR05*. This document is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-CTR05.pdf.

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

The counter frequency sources and 3.3 V compatibility apply to hardware manufactured at revision 3 and later

The clock input frequency sources and compatibility with a 3.3 V signaling environment that are listed in this specification apply to hardware built at revision 3 and later.

Digital input / output

Table 4-1. Digital I/O specifications

Digital type	Discrete, 5V/TTL compatible
	Output: 74ACT273
	Input: 74LS373
Number of I/O	8 input, 8 output
Configuration	1 bank of 8 as output, 1 bank of 8 as strobed input
Input high voltage	*2.0 V min, 7.0 V absolute max*
Input low voltage	*0.8 V max, –0.5 V absolute min*
Output high voltage	*3.94 volts min @ -24 mA (Vcc = 4.5 V)*
Output low voltage	*0.36 volts max @ 24 mA (Vcc = 4.5 V)*
Data transfer	Programmed I/O
Power-up / reset state	Digital outputs reset to TTL low
Din strobe	Active low latch enable input, internally pulled high through 10 KOhm resistor
Din strobe pulse width high/low	15 nS min
Data setup to Din strobe	*5 nS min*
Data hold from Din strobe	*20 nS min*

Interrupt

Table 4-2. Interrupt specifications

Number of user interrupts	One
PCI Interrupt	PCI INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enables	External: IRQ ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9030-AA60PI; 0 = disabled, 1 = enabled (default)
Interrupt sources	External: IRQ IN, polarity programmable through PCI9030-AA60PI; 1 = active high, 0 = active low (default).
	IRQ IN maps to PLX 9030 LINT1.

Counter

Refer to the CTS9513-2 data sheet for complete 9513 specifications and operating modes. The SAVE command for the CTS9513 device does not behave predictably when using clocks which are not synchronous with the logic timing. The CTS9513-2 data sheet is available on our web site at www.mccdaq.com/PDFmanuals/9513A.pdf.

Table 4-3. Counter specifications

Parameter	Conditions
Counter type	9513
Configuration	One 9513 device. Five up/down counters, 16 bits each.
Compatibility	5V/TTL
The 9513 device is programmable for:	
Clock source	Software selectable: External: ▪ Counter 1-5 clock inputs ▪ Counter 1-5 gate inputs Internal: ▪ Terminal count of previous counter ▪ X2 clock frequency scaler
Gate:	Software selectable source: External (default logic high): ▪ Active high or low level or edge, counter 1 – 5 gate input ▪ Active high level previous gate or next gate ▪ All external gate signals (CTRxGATE) individually pulled up through 10K resistors to +5V. Internal: ▪ Active high previous counter terminal count ▪ No gating.
Output:	Software selectable: ▪ Always low ▪ High pulse on terminal count ▪ Low pulse on terminal count ▪ Toggle on terminal count ▪ Inactive, high impedance at user connector counter # output.
Osc Out	Software selectable source: ▪ Counter # input ▪ Gate # input ▪ Prescaled clock source (X2 clock frequency scaler) Software selectable divider: ▪ Division by 1-16 Software selectable enable: ▪ On or low impedance to ground.
Clock input frequency	6.8 MHz max (145 nS min period)
X2 clock input sources	Software selectable: ▪ 1.0 MHz (10 MHz Xtal divided by 10) ▪ 5.0 MHz (10 MHz Xtal divided by 2) ▪ 3.3 MHz (33 MHz PCI clock divided by 10) ▪ 1.67 MHz (33 MHz PCI clock divided by 20)
X2 clock frequency scaler	BCD scaling (X2 divided by 10, 100, 1000 or 10000) or Binary scaling (X2 divided by 16, 256, 4096 or 65536)
High pulse width (clock input)	*70 ns min*
Low pulse width (clock input)	*70 ns min*
Gate width high	*145 ns min*
Gate width low	*145 ns min*

Parameter	Conditions
Input low voltage	*-0.5 V min, 0.8V max*
Input high voltage	*2.2 V min, Vcc max*
Output low voltage @ IIl=3.2 mA	*0.4 V max*
Output high voltage @ IIH= -200 uA	*2.4 V min*
Crystal oscillator frequency	10 MHz
Frequency accuracy	50 ppm

Power consumption

Table 4-4. Power consumption specifications

+5 V	307 mA typical, 549 mA max. Does not include power consumed through the I/O connector.
+5 V available at connector	1 A max

Environmental

Table 5. Environmental specifications

Operating temperature range	0 to 55 °C
Storage temperature range	-20 to 70 °C
Humidity	0 to 90% non-condensing

Mechanical

Table 4-6. Mechanical specifications

Card dimensions	132.3 mm (L) x 106.7 mm (W) x 11.65 mm (H)
Form factor	Universal PCI keying. Compatible with either 3.3 V or 5 V PCI signaling environments.

Main connector and pin out

The J1 connector is compatible with the CIO-CTR05 and the CIO-CTR10.

Table 4-7. Main connector specifications

Connector type	37 pin shielded D-type, right angle
Compatible cables	C37FF-x, unshielded ribbon cable
	C37FFS-x, shielded round cable
Compatible accessory products	CIO-MINI37 CIO-MINI37-VERT CIO-TERMINAL SCB-37

J1

Table 4-8. Main connector J1 pin out

Pin	Signal Name
1	IRQ INPUT
2	IRQ ENABLE
3	DOUT7
4	DOUT6
5	DOUT5
6	DOUT4
7	DOUT3
8	DOUT2
9	DOUT1
10	DOUT0
11	GND
12	CTR5GATE
13	CTR5CLK
14	CTR4GATE
15	CTR4CLK
16	CTR3GATE
17	CTR3CLK
18	CTR2GATE
19	CTR2CLK
20	PC +5V
21	DIN STROBE
22	DIN7
23	DIN6
24	DIN5
25	DIN4
26	DIN3
27	DIN2
28	DIN1
29	DIN0
30	OSC OUT
31	CTR5OUT
32	CTR4OUT
33	CTR3OUT
34	CTR2OUT
35	CTR1OUT
36	CTR1CLK
37	CTR1GATE

EC Declaration of Conformity

We, Measurement Computing Corporation, declare under sole responsibility that the product

PCI-CTR05	5-counter board for the PCI bus
Part Number	*Description*

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other informative documents:

- EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.
- EN 55022 Class B (1995): Radiated and conducted emission requirements for information technology equipment.
- ENV 50204 (1995): Radio-frequency electromagnetic field immunity
- EN 55024 (1998): EC generic immunity requirements.
- EN 50082-1 (1997): EC generic immunity requirements.
- EN 61000-4-2 (1995): Electrostatic discharge immunity.
- EN 61000-4-3 (1997) ENV 50204 (1996): RF immunity.
- EN 61000-4-4 (1995): Electric fast transient burst immunity.
- EN 61000-4-5 (1995): Surge immunity.
- EN 61000-4-6 (1996): Radio frequency common mode immunity.
- EN 61000-4-8 (1994): Power frequency magnetic field immunity.
- EN 61000-4-11 (1994): Voltage dip and interrupt immunity

Carl Haapaoja, Vice-President of Design Verification

Measurement Computing Corporation
16 Commerce Boulevard,
Middleboro, Massachusetts 02346
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@mccdaq.com
www.mcc.com